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(54) CROSS-LAPPER MODIFICATION

(71) We, WIRA, a British Company limited by guarantee under the Companies Acts, 1908 to 1917, 1948 and 1967, of Headingley Lane, Leeds, LS6 1BW, West Yorkshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a cross-lapping mechanism of the type which is used for cross-lapping fibrous webs and which comprises a storage jigger and a delivery jigger, each comprising a carriage and an endless belt or the like (lattice) and each being adapted to be reciprocated back and forth and also to convey fibrous web fed thereto, the storage jigger being arranged to feed the web to the delivery jigger, and the delivery jigger being arranged to cross lap the fibrous web on a suitable receiving surface. Such cross-lapping mechanism will be referred to hereinafter and in the appended claims as "cross-lapping mechanisms of the type aforesaid".

Known cross-lapping mechanisms of the type aforesaid are employed in the manufacture of non-woven fabrics to lay down carded fibrous web in overlapping folds on a moving conveyor. In one commonly used such mechanism, a feed lattice introduces carded web into the mechanism at a substantially constant speed and the web is laid to and fro across the width of a lower conveyor by means of the delivery jigger which comprises its endless moving belt or lattice with long horizontal reaches and which is mounted on its carriage which reciprocates horizontally over, and transversely with respect to, the lower conveyor. The storage jigger is conventionally arranged between the delivery jigger and feed lattice. The function of the storage jigger is to accommodate, on the upper reach of its own lattice, and on the upper reach of the delivery jigger lattice, sufficient of web for the delivery jigger to pay out web on to the lower conveyor evenly and without unnecessary tension. The surface speed of the delivery jigger lattice with respect to its carriage and the rate of traverse of the delivery jigger carriage are approximately equal to the surface speed of the feed lattice, whilst as regards the storage jigger, the surface speed of the storage jigger lattice with respect to its carriage varies between 3/2 and 1/2 that of the feed lattice depending whether the carriage is moving in the same direction as or the opposite direction to the upper reach of feed lattice. The storage jigger and delivery jigger carriages reciprocate in phase, but the storage jigger carriage reciprocates at half the amplitude of the delivery jigger carriage, and the speed of reciprocation of the storage jigger carriage is selected so that the speed of the storage jigger lattice with respect to space (or the machine frame) is constant and equal to the speed of the feed lattice.

The mechanism essentially has two drive systems. One for the storage jigger and delivery jigger lattices, and another for the storage jigger and delivery jigger carriages.

For each cross-lapping mechanism of the type aforesaid, and depending upon the desired output and the geometry of the mechanism, there is a "theoretically correct" lattice speed for each of the storage and delivery jigger lattrices to give the desired cross lapping of the web, and when references hereinafter and in the appended claims are made to the theoretical speed of the lattices, the theoretically correct speed for the mechanism as indicated above is intended.

A conventional drive system for the lattices comprises a sprocket chain driven by a main drive sprocket positionally fixed relative to the machine frame, the chain in turn driving a delivery jigger lattice drive sprocket which is mounted on the delivery jigger carriage and a storage jigger lattice drive sprocket mounted on the storage jigger carriage. The chain passes over an idler sprocket roller also mounted on a storage jigger carriage and two further idle rollers which revolve freely on axes fixed relative to the machine frame.

The main drive sprocket revolves at a constant speed, but as the storage jigger drive sprocket moves to and fro with the reciprocation of the storage jigger carriage, the rate of rotation of the storage jigger drive sprocket is determined by the sum of or the difference between the rotational speed of the main drive sprocket and the linear speed of the storage jigger drive sprocket to give the speed variation relative to the storage jigger carriage as mentioned above and ensuring that the linear speed of the storage jigger lattice with respect to space or the fixed frame of the machine is, however, constant and independent of the direction of movement of the storage jigger carriage. As the chain passes over two sprockets carried by the storage jigger carriage and only one carried by the delivery jigger carriage, the rotational speed of the delivery jigger lattice drive sprocket remains constant throughout the operation to ensure that there is a constant rate of delivery of web from the mechanism. Instead of using a drive sprocket and drive chain, it is possible alternatively to use belt and pulleys or similar flexible member and rotational member drive arrangements and whilst reference will be made predominantly to drive chains and sprockets for the sake of simplicity, it is to be understood that these terms include other flexible members and rotational drive means for such members. For the purposes of this Specification and the claims appended hereto, such jigger lattic drive system will be referred to as a "conventional jigger lattice drive system".

In theory this conventional jigger lattice drive system should result in a constant tension of the web as it is fed to the storage jigger, is transferred between the two jiggers and is delivered by the delivery jigger. However, in practice it is found that, possibly at least partly because of the different structure of one side of a carded web compared with the other, the tension of the web varies during the cycle of operations of the cross lapper with the result that the folds of web laid on lower conveyor are most stretched and therefore lighter at one side than at the other side.

It is an object of the invention to provide a cross lapping mechanism of the type aforesaid wherein the aforesaid disadvantage of uneven stretching of the folds of web laid on the lower conveyor is obviated or mitigated.

According to the present invention there is provided a cross lapping mechanism of the type aforesaid, including a jigger lattice drive system adapted to cause the storage jigger and delivery jigger lattices when the carriages thereof are travelling in at least one direction, to be drive at a speed different from the theoretical speed as herein defined.

Preferably, the lattice drive system is a conventional jigger lattice drive system as herein defined modified to incorporate a differential mechanism to increase the speed of the said lattices relative to the theoretical speeds when the jigger carriages move in one direction and to decrease the said speed relative to the theoretical speeds when said carriages move in the opposite direction.

Preferably, the differential mechanism is defined by a loop of chain on the drive side of said main drive sprocket, said loop having a bight and two horizontal reaches, and bight moving means for imparting to said bight a movement which has a horizontal component and is in phase with the horizontal movement of said jigger carriages so as to add to or subtract from the linear speed of that portion of said chain that effects a drive to said lattices. Preferably, said bight moving means comprises a sprocket wheel which is freely rotatable about an axis which can be moved to and fro in the general direction of the reaches of the chain loop.

A conventional means of driving the storage jigger carriage and delivery jigger carriage includes an endless sprocket chain or the like arranged around two freely rotatable sprocket wheels the axes of which are attached to the storage jigger carriage at horizontally spaced locations. The chain is fixed at a first point between the wheels, which point is fixed in space and at a second point at the opposite side of the sprocket wheels to the delivery jiigger carriage and also to a further endless chain. The delivery jigger carriage is driven by movement of said further endless chain which is driven reversibly through a sprocket wheel which in turn is driven by a reversing clutch drive. When the delivery jigger carriage moves horizontally a distance x, the storage jigger carriage moves in the same direction by a distance $x/2$. As is the same with the lattice drive system, this conventional carriage drive system is analytically correct, but in practice it is found that again possibly at least partly because of the different frictional properties between one side of a carded web and the other, the tension of the web varies during the cycle of operations of the cross-lapper mechanism with the result that the folds of web are more stretched and therefore lighter at the side corresponding to the inward end of the jigger carriage run than at the other side.

It is therefore an ancillary object of the invention to provide a cross-lapping mechanism of the type aforesaid which in addition to having a modified lattice drive, also embodies a carriage drive which contributes to obviating or mitigating the disadvantage mentioned herein.

According to a preferred feature of the in-

vention, the storage jigger and delivery jigger are connected to a carriage drive system operable to reciprocate the storage jigger and delivery jigger carriages in phase and such that the amplitude of movement of the storage jigger carriage differs fractionally from half of the amplitude of movement of the delivery jigger carriage.

It is preferred that the amplitude of movement of the storage jigger carriage should be fractionally less than half of the amplitude of movement of the delivery jigger carriage.

The carriage system may be adapted such that in operation, the amplitude of movement of the storage jigger carriage is $2\frac{1}{2}$ to 13% less than half of the amplitude of movement of the delivery jigger carriage.

The carriage drive system may be capable of adjustment so that the fraction by which the amplitude of movement of the storage jigger carriage differs from half of the amplitude of movement of the delivery jigger carriage may be varied.

In a preferred case, the carriage drive system may include a reversible drive and first drive sprocket means around which is trained drive chain means, belt means or the like to which the delivery jigger carriage is attached to be reciprocated thereby, said storage jigger carriage having displacement chain means, belt means or the like which is connected to the delivery jigger carriage to be displaced thereby so as to cause displacement of the storage jigger carriage by half the displacement of the delivery jigger carriage, and said carriage drive system further including a drive connection between the reversible drive and second drive sprocket means around which the displacement chain means, belt means or the like is trained to be driven thereby so as to superimpose drive on said displacement chain means, belt means or the like whereby the amplitude of the displacement of the storage jigger carriage differs fractionally from half of the amplitude of displacement of the delivery jigger carriage. Preferably the second drive sprocket means is operatively connected to the aforesaid bight moving means so as to effect displacement thereof.

In an alternative arrangement, the carriage drive system includes a reversible drive, first drive sprocket means around which is trained first drive chain means, belt means or the like to which the delivery jigger carriage is connected to be reciprocated thereby, and second drive sprocket means around which is trained second drive chain means, belt means or the like to which the storage jigger carriage is connected to be reciprocated thereby, and transmission means for ensuring that in operation the amplitude of movement of the storage jigger carriage differs fractionally from half of the amplitude of movement of the delivery jigger carriage.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying diagramatic drawings, wherein:—

Figure 1 is a side elevation illustrating a conventional cross-lapping mechanism;

Figure 2 is a side elevation illustrating a conventional lattice drive system for the cross-lapping mechanism of Figure 1;

Figure 3 is a side elevation illustrating a conventional carriage drive for the cross-lapping mechanism of Figure 1;

Figure 4 is a side elevation illustrating the conventional lattice drive shown in Figure 2 when modified in accordance with the embodiment of the invention;

Figure 5 is a side elevation illustrating a carriage drive system as modified in accordance with a preferred arrangement of the invention;

Figure 6 is a side elevation for the purposes of explaining how the drive system of Figures 4 and 5 may be combined; and

Figure 7 is a side elevation illustrating another embodiment of a carriage drive system.

Referring to the drawings, a conventional cross-lapping mechanism of the type aforesaid is shown in Figures 1, 2 and 3. The storage jigger 16 has a carriage 18 on which is mounted an endless chain or the like 51 (Figure 3) arranged around two freely rotatable idler sprocket wheels 55, the spindles 56 of which are carried by carriage 18 at horizontally spaced locationals. The chain 51 is fixed at a point 54 on the top reach between the wheels 55, such point 54 being fixed in space and being defined by a part of the stationary frame 5 shown in Figure 3. The chain 51 is also connected at a second point 50 on the other reach to the delivery carriage 15 of the delivery jigger 13 and also to a further endless chain 53 trained round horizontally spaced sprockets 57 and 58, sprocket 57 being a drive sprocket and sprocket 58 being an idler sprocket. The delivery jigger is driven back and forth in a horizontal plane by a reversing clutch drive RC which reversibly drives sprocket 57. It can be understood that when the delivery jigger carriage moves by a distance x, the storage jigger carriage moves by a distance $x/2$ and the movements of the jiggers will be in phase. The jiggers 13 and 16 are provided with their own feed conveyor lattice 14, 17 respectively which are driven in opposite directions by the conventional lattice drive system shown in Figure 2.

A conventional drive system for the lattices is shown in Figure 2. It comprises a sprocket chain 101, driven by a main drive sprocket 102 positionally fixed relative to

the machine frame, the chain in turn driving a delivery jigger lattice drive sprocket 103 which is mounted on the delivery jigger carriage 15 and a storage jigger lattice drive sprocket 104 mounted on the storage jigger carriage 18. The chain passes over an idle sprocket roller 105 also mounted on the storage jigger carriage and two further idle rollers 106 and 107 which revolve freely on axes fixed relative to the machine frame.

The main drive sprocket 102 revolves at a constant speed, but as the storage jigger drive sprocket 104 moves to and fro as shown by arrow 104A with the reciprocation of the storage jigger carriage 18, the rate of rotation of the storage jigger drive sprocket 104 is determined by the sum of or the difference between rotational speed of the main drive sprocket 102 and the linear speed of the storage jigger drive sprocket 104 to give the speed variation relative to the storage jigger carriage as mentioned herein and ensuring that the linear speed of the storage jigger lattice with respect to space or the fixed frame of the machine is constant and independant of the direction of movement of the storage jigger carriage. As the chain passes over two sprockets carried by the storage jigger carriage and only one carried by the delivery jigger carriage, the rotational speed of the delivery jigger carriage drive sprocket remains constant throughout the operation to ensure that there is a constant rate of delivery of web from the mechanism.

In theory, this lattice drive system should result in a constant tension of the web as it is fed to the storage jigger, is transferred between the two jiggers and is delivered by the delivery jigger. However, in practice it is found that, probably at least partly because of the different structure of one side of the carded web compared with the other, the tension of the web varies during the cycle of operations of the cross-lapper with the result that the folds of web laid on the lower conveyor are more stretched and therefore lighter at one side than at the other.

In operation of the conventional mechanism described, a feed lattice 10 introduces carded web 11 on to the storage jigger 16 at a substantially constant speed, and the web is laid to and fro across the width of a lower conveyor 12 by means of the delivery jigger 13. The delivery jigger is supplied with the web 11 from the storage jigger whose function is to accommodate on the upper reach of its conveyor lattice 17, sufficient of web 11 for the delivery jigger 13 to pay out web on to the lower conveyor 12 evenly and without unnecessary tension. The surface speed of the delivery jigger lattice 14 with respect to its carriage is approximately equal to the surface speed of the feed lattice 10, whilst the storage jigger 16 reciprocates in phase with the delivery jigger carriage, but has half the amplitude of movement. The surface speed of the storage jigger lattice 17 with respect to its carriage varies between $1\frac{1}{2}$ times and $\frac{1}{2}$ of that of the lattice 10, depending upon whether the carriage 18 is moving in the same direction as or the opposite direction to the upper reach of the lattice 10.

Whilst this arrangement is sound from a theoretical point of view, it has been found to have the shortcomings mentioned, and we have found that by varying the lattice speeds on the one hand and by making the amplitude of movements the storage jigger carriage differ fractionally from half the amplitude of movement of the delivery jigger carriage on the other hand, the operation of the mechanism is improved.

Referring to Figure 5 the carriage 18 on which the lattice is mounted is itself mounted for independent reciprocatory movement in space in a horizontal plane on wheels 40. Sprocket wheels 55 are freely rotatable about axes 56 fixed in relation to the carriage 18. An endless loop of sprocket chain 51 passes round the sprocket wheels 55. At a point 50 between the sprocket wheels the chain is connected to the delivery jigger carriage 15 which is adapted to be reciprocated in a horizontal plane by means of a loop of chain 53 driven reversibly by sprocket wheel 57. The fixed point 54 is dispensed with and an additional drive sprocket wheel 41 driven, via gearing, from the shaft of sprocket wheel 57 provided as shown, the chain 51 being round this sprocket wheel 41. It will be understood that if the wheel 41 is driven in a clockwise direction at a much slower surface speed than the speed imparted to the point 50 by carriage 15, when carriage 15 is moving to the right in Figure 3, the carriage 18 will be traversed towards the right in Figure 3 at a faster rate, and towards the left in Figure 3 slower, when carriage 15 moves to the left in Figure 3, than when the arrangement is as in Figure 3. On the other hand, slow rotation of sprocket wheel 41 in an anticlockwise direction with carriage 15 moving to the right in Figure 3, retards the movement of carriage 18 to the right in Figure 3, and with the carriage 15 moving to the left in Figure 3, accelerates its movement towards the left in Figure 3, as compared with the conventional arrangement wherein point 54 is fixed (Figure 2).

In use, direction of movement of sprocket wheel 41 is changed in time with the reversal of the movement of carriage 15 and its speed is adjusted by means of the train of gears and pulleys 42, 43, 44 and 45 (which may include a change wheel) so as to reduce the rate and extent of movement of the storage jigger carriage during both its outer and inner runs so as to minimize the tension

variations in the fibrous web. It is expected that a reduction in rate and extent of movement by between 2½ and 15% will be effective.

Figure 4 shows how the conventional lattice drive system of Figure 2 can be varied in accordance with the invention. The sprocket chain 101 has an extra loop located in such a position relative to the direction of rotation of drive sprocket 102 that the chain runs from the loop to sprocket 102. The extra loop is defined by a horizontal reaches 101A and 101B and a bight 108 in which sprocket 109 is engaged. An extra idler roller 110 is necessarfy and there may be need for re-location of idle rollers 106 and 107, and addition of spring loaded roller 112 and extra loop of chain 113. It can be seen that movement of sprocket 109 to the left (in Figure 4) will augment the action of the clock-wise turning sprocket 102, as far as that portion of chain runs over sprocket 103 and 104 is concerned, whilst the movement of sprocket 109 to the right will diminish it, to the effect that the speed of both the lattices will be increased and reduced relative to the theoretical speeds in respective circumstances. If the jigger carriages maintain an exact 2:1 ratio of horizontal traverse, there would be no slack chain to allow for movement of sprocket 109 and in this circumstance the extra loop of chain 113 and the spring-loaded roller 112 are required.

However, in accordance with the preferred arrangement, it is desirable that jigger carriages should not maintain an exact 2 to 1 ratio and to this end the carriage drive system is modified as shown in Figure 5 as explained above, or Figure 7 to be explained hereinafter.

Figure 6 shows a modification of the arrangement of Figure 5. The drive as shown in 6 may be applied to one side of the storage jigger carriage whilst the drive as shown in Figure 5 is applied to the other side. The modification resides in that an ended sprocket chain 51A fixed at one end to a point 50A (corresponding to point 50 in Figure 5) which is caused to reciprocate horizontally and at the other end 115 to spring 116 in turn connected to the affixed point on the frame of the machine, replaces endless chain 51. The chain 51A passes round sprocket wheel 55A which turns freely on an axis fixed to the storage jigger carriage 18 and round sprocket 114 which is fixed to the machine frame. The chain also passes over sprocket wheel 41A which operates as wheel 41 in Figure 5. When point 50A is forced to move to the left (in Figure 6) the sprocket wheel 55A (and thus carriage 18) moves to the left a distance which is half of (a) the sum of the distance moved by point 50A and the length of chain moved by the anti clockwise rotation of sprocket 41A or (b) the difference between the distance moved by point 50A and the length of chain moved by the clockwise rotation of sprocket wheel 41A. As sprocket 41A moves clockwise or anti clockwise so spring 116 expands or contracts in compensation. When point 50A moves to the right, the positive drive on the other side of the carriage moves the carriage to the right and the chain remains taught and again movement of the carriage is as (a) or (b) above.

The carriage drive system of Figure 6 can advantageously be coupled to the lattice drive system of Figure 4. To do this, the spring 116 (Fig. 6) is dispensed with and the end 115 of chain 51A is attached at 117 to a lever 120 (Fig. 4) which is pivoted to the machine frame at 121 and carriage sprocket 109 thus, as sprocket 41A rotates clockwise, sprocket 109 is pulled to the left, the rate of linear movement of lattice drive chain 101 over the sprockets 103 and 104 is increased and loop of chain 113 is reduced. When sprocket 41A turns anti clockwise and the tension at end 115 would otherwise tend to slacken, because sprocket 109 is on the tensioned side of drive sprocket 102, the tension produced by sprocket 102 pulls the axis of sprocket 109 to the right and produces an effect on end 115 analogous to that of spring 116. Movement of sprocket 109 to the right in Figure 4 causes the rate of linear movement of chain 101 over the jigger lattice drive sprockets 104 and 103 to be decreased, and allows the spring loaded roller 112 to pull out a loop of chain 113.

As explained, the effect of the slight movement of sprockets 41 and 41A is to vary the ratio of the amplitude of the reciprocation of the respective storage and delivery jigger carriages from its conventional 2 to 1 value. This means that some slack will occur in chain 101 at some part of the cycle and experience has shown that this allows for some linear movement of sprocket 109 without the need for any extra loop of chain 113. However, if the linear movement of sprocket 109 is sufficently greater than the movement of chain caused by rotation of sprocket 41A, e.g. if end 115 of chain 51A is attached to the lever 120 nearer to the pivot than the axis of sprocket 109 then loop 113 will be necessary.

A different carriage drive system as an alternative to the system shown in Figure 5 is shown in Figure 7. The drive shaft sprocket wheel 57, which is rotated reversibly to impart reciprocatory motion to carriage 13, is coupled by transmission means including chain and sprocket drive 61, to shaft 58 on which is fixed sprocket 59 driving a chain loop 60 to a point on which is fixed carriage 18. The choice of sprocket wheels 61 and 59 is so arranged that the amplitude of movement of chain loop 60 is

fractionally less than half the amplitude of movement of chain 53, whilst the carriages 15 and 17 remain in phase. This system does not lend itself to a simple coupling of this carriage and lattice drives as does the arrangement of Figure 5 as modified by the arrangement of Figure 6.

Whereas in the preferred cases, endless chains are used for the chain means, belt means or the like of the carriage drive system, an ended chain could be employed, or separate chains could be used and instead of a chain, another form of substantially inextensible flexible band could be used.

Whereas the invention has been described as applied to one particular form of horizontal cross-lapper, it may in fact be found to be applicable to other forms of cross-lapping mechanisms of the type aforesaid, and application to such forms is to be regarded as being within the scope of the invention.

WHAT WE CLAIM IS:—

1. A cross-lapping mechanism of the tyep aforesaid, including a jigger lattice drive system adapted to cause the storage jigger and delivery jigger lattices when the carriages thereof are travelling in at least one direction, to be driven at a speed different from the theoretical speeds as herein defined.

2. A mechanism according to claim 1, wherein the lattice drive system is a conventional jigger lattice drive system as herein defined modified to incorporate a differential mechanism to increase the speed of the said lattices relative to the theoretical speed when the jigger carriages move in one direction and to decrease the said speed relative to the theoretical speeds when said carriages move in the opposite direction.

3. A mechanism according to claim 2, wherein the differential mechanism is defined by a loop of chain on the drive side of said main drive sprocket, said loop having a bight and two horizontal reaches, and bight moving means for imparting to said bight a movement which has a horizontal component and is in phase with the horizontal movement of said jigger carriages so as to add to or subtract from the linear speed of that portion of said chain, that effects a drive to said lattices.

4. A mechanism according to claim 3, wherein said bight moving means comprises a sprocket wheel which is freely rotatable about an axis which can be moved to and fro in the general direction of the reaches of the loop of chain.

5. A mechanism according to any of claims 1 to 4 wherein the storage jigger and delivery jigger carriages are connected to a carriage drive means operable to reciprocate the storage jigger and delivery jigger carriages in phase and such that the amplitude of movement of the storage jigger carriage differs fractionally from half of the amplitude of movement of the delivery jigger carriage.

6. A mechanism according to Claim 5, wherein the amplitude of movement of the storage jigger carriage is fractionally less than half the amplitude of movement of the delivery jigger carriage.

7. A mechanism according to Claim 5, wherein the carriage drive means is adapted such that in operation, the amplitude of movement of the storage jigger carriage is $2\frac{1}{2}$ to 15% less thanu half of the amplitude of movement of the delivery jigger carriage.

8. A mechanism according to any one of claims 5 to 7, wherein the carriage drive means is capable of adjustment so that the fraction by which the amplitude of movement of the storage jigger carriage differs from half of the amplitude of movement of the delivery jigger carriage may be varied.

9. A mechanism according to any one of claims 5 to 8 wherein the carriage drive means includes a reversible drive and first drive sprocket means around which is trained drive chain means, belt means or the like to which the delivery jigger carriage is attached to be reciprocated thereby, said storage jigger carriage having displacement chain means, belt means or the like which is connected to the delivery jigger carriage to be displaced thereby so as to cause displacement of the storage jigger carriage by half the displacement of the delivery jigger carriage and said carriage drive means further including a drive connection between the or another reversible drive and second drive sprocket means around which the displacement chain means, belt means or the like is trained to be driven thereby so as to superimpose drive on said placement chain means, belt means or the like whereby the amplitude of the displacement of the storage jigger carriage differs fractionally from half of the amplitude of displacement of the delivery jigger carriage.

10. A mechanism according to Claim 9, wherein the drive chain means, belt means or the like is endless.

11. A mechanism according to Claim 9 or 10, wherein the displacement chain means, belt means or the like is endless and is trained round spaced idler sprocket means.

12. A mechanism according to any of claims 5 to 8 wherein the carriage drive means includes a reversible drive first drive sprocket means round which is trained first drive chain means, belt means or the like to which the delivery jigger carriage is connected to be reciprocated thereby, and second drive sprocket means, around which is trained second drive chain means, belt means or the like to which the storage jigger

carriage is connected to be reciprocated thereby, and transmission means for ensuring that in operation the amplitude of movement of the storage jigger carriage differs fractionally from half of the amplitude of movement of the delivery jigger carriage.

13. A mechanism according to Claim 12, wherein either or each of the first chain means belt means or the like and second chain means, belt means or the like is endless.

14. A mechanism according to Claim 9 and Claim 3 or 4, wherein the second drive sprocket means is operatively connected to said bight moving means to cause or allow the same to move, with rotation of said sprocket means.

15. A mechanism substantially as hereinbefore described with reference to Figure 4, or Figures 4 and 5, or Figures 4 and 6, or Figures 4 and 7 of the accompanying drawing.

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Sheet 1

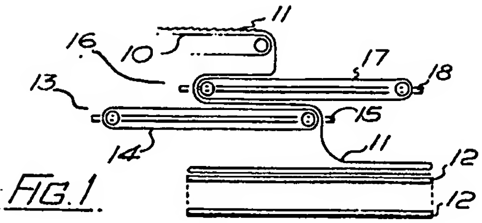
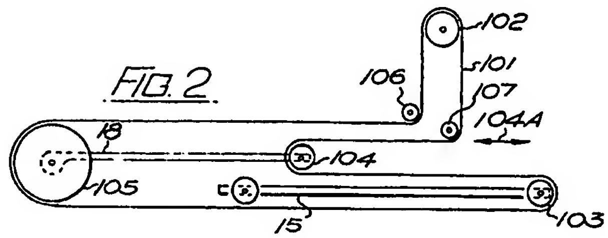


FIG. 1

FIG. 2



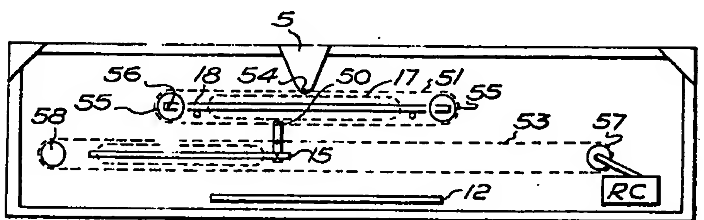
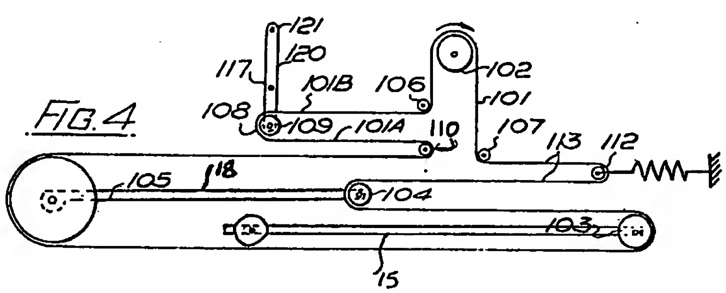


FIG. 3

FIG. 4



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Sheet 2

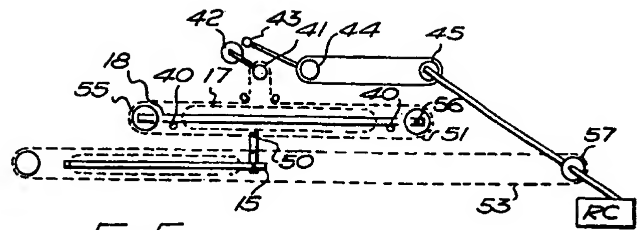

FIG.5

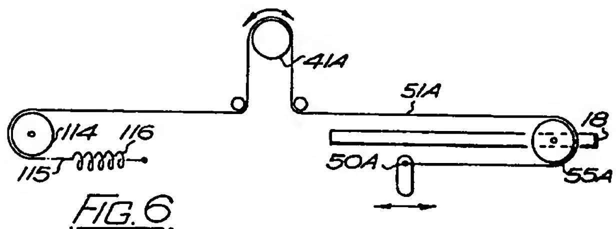

FIG.6

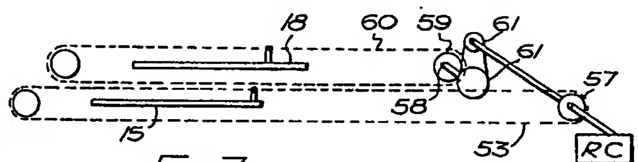

FIG.7